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ABSTRACT

This document provides elementary teachers with an annotated index according to (Houghton-Mifflin, 1976), followed by suggestions for activities related to the topics. Indexed topics, which comprise a major portion of the document, include basic energy information, society's dependence on energy, problems and advantages of energy alternatives, and energy issues relevant to the state of Minnesota. The index refers to the unit number, lesson number, and the appropriate pages in the teacher's guide. The background material for teachers presents definitions, lists energy sources, uses and conservation, and discusses states, storage and conversion of energy. Related activities include energy bingo, presentation of television commercials to convince people to conserve energy, school and home energy surveys, and interviews with older people to determine how energy was used in the early part of the 20th century. (KC)

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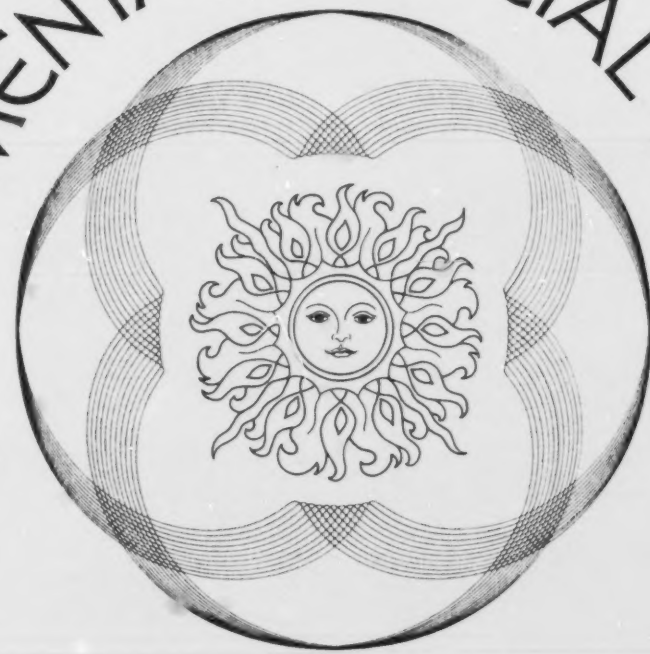
ENERGY EDUCATION IN ELEMENTARY SOCIAL STUDIES



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MINNESOTA ENERGY AGENCY
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980 American Center Building
150 East Kellogg Boulevard
St. Paul, Minn. 55101
(612) 296-5769

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Windows On Our World
- Houghton Mifflin, Publishers

GRADE LEVEL ANNOTATED INDEX OF LESSONS RELATED TO ENERGY EDUCATION WITHIN *WINDOWS ON OUR WORLD**

Levels 1-6

*Houghton-Mifflin 1976

Minneapolis Public Schools

John B. Bastolich, Consultant
Department of Social Studies K-12

Teacher developers:

Elizabeth Koenig
Jean Rifley
Kathryn Roberts
Elizabeth J. White

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Minnesota Energy Agency
980 American Center Building
150 East Kellogg Boulevard
St. Paul, Minnesota 55101

ENERGY EDUCATION IN ELEMENTARY SOCIAL STUDIES

Windows On Our World

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ENERGY EDUCATION AND SOCIAL STUDIES

Windows On Our World

FORMAT:

A team of elementary teachers of social studies indexed the *Holt Databank System* and the *Windows On Our World* program materials to an Outline of Energy Education Topics. This outline of concepts was developed by the Energy Task Force of the Minnesota Department of Education.

Nineteen supplementary activities were developed by the team, and are included after the annotated index. Also included are ideas for using selected activity cards from *Windows On Our World*.

ENERGY EDUCATION AND SOCIAL STUDIES

A Rationale

Energy Education becomes a more crucial component of the curriculum with each passing year. We recognize that today's social studies program must include a conscious and planned effort to make students more knowledgeable about energy; sources, uses, problems and possible solutions. It is important to do this without losing sight of the other equally crucial social needs of our society which ought to be reflected in our social studies - the positive and accepting view of self and others; the understanding and appreciation of diversity among people; the structure and function of the institutions in our culture and in other cultures; an introduction to the physical geography of the world; and an appreciation of the natural features, resources, and living things that comprise the world we live in.

This document, therefore, suggests that as we teach social studies and try to maintain a balanced approach to the many areas that beg to be emphasized, we can recognize the opportunities to develop and extend those ideas which are identified as energy education.

OUTLINE OF ENERGY EDUCATION TOPICS

(Used as the basis for the analysis of the Social Studies programs.)

I. BASIC ENERGY INFORMATION

- A. Definition - Properties
- B. Sources - Renewable and Non-renewable
- C. Forms: chemical, mechanical, radiant, nuclear, electrical
- D. Uses: Residential, commercial, industrial (agriculture, food processing, mining, manufacturing), transportation, utility generation
- E. Conversion Systems/Technologies
- F. Ways of conserving

II. SOCIETY's DEPENDENCE ON ENERGY

- A. Demands/needs related to resources (end-use) and life style
- B. Effects upon economy and economic system
- C. Effects on Political Relationships: local, national, international
- D. Values

III. POSSIBLE SOLUTIONS - PROBLEMS AND ADVANTAGES OF ENERGY ALTERNATIVES

- A. Alternative sources (types, uses, supply, time-lag) (values: cost, change in life style, trade-offs)
- B. Conservation (types, uses, supply, time-lag) (values: cost, change in life style, trade-offs)

IV. MINNESOTA'S ENERGY ISSUES

- A. Location, climate
- B. Sources available
- C. Problems with sources
- D. Ownership
- E. Control and effect of government policies and regulations
- F. Transportation
- G. Values

ENERGY CONCEPTS FOR ELEMENTARY EDUCATION*

Background Material for Teachers

DEFINITIONS

1. Energy is the capacity to do work or make something move. The "go" of things.

   A. Power is the rate that energy is produced or used.
   B. Efficiency is the amount of work done in proportion to the energy used.
   C. Work is done when an object is moved.
   D. Force is required to produce an acceleration in the motion of a body.

2. Energy is a resource.

3. Energy is the ability to cause change.

SOURCES: WHERE DOES ENERGY COME FROM?

1. Primary Sources

   Primary sources are sources naturally available on the earth.

   A. Renewable sources are recurring or continuous.

      1. The sun is the main source of energy.
      2. Other renewable sources of energy are: geothermal, wind, hydro, tidal and organic material.

         Although they are available, the following sources are little used and need further development:

         a. Wind power
         b. Solar power

* From Energy Task Force, Minnesota Department of Education

c. Tides
d. Geothermal
e. Organic wastes
f. Peat (through some processes of recovery)

B. Non-renewable sources are sources that take a great deal of time and cannot be replenished in human time spans.

1. Some non-renewable sources are fossil fuels: coal, oil, natural gas, and peat.

a. Currently most of our usable energy comes from fossil fuels.
b. Fossil fuels are non-renewable resources in limited supply.
c. No one knows exactly how much fossil fuel remains. Estimates depend on finding out where they are available, how easy it would be to recover them, and the cost of this recovery.
d. Some fossil fuels are in difficult places for recovery (e.g., oil, shale, tar sands, liquid natural gas and liquid petroleum gas.)

2. Another non-renewable source is uranium used in nuclear fission reactors.

2. Secondary Sources

Secondary sources of energy are products of human technology.

A. Electricity is a secondary source of energy. Primary sources of energy are used to make it.
B. Some other secondary sources of energy are: solid wastes, fuel cells and the conversion of chemical energy.

3. Differences among energy sources:

A. Some work only under certain conditions or are practical only under certain conditions.
B. Some work only in certain places.
C. Some take much time to form.
D. Some are slower and less efficient.
E. Some take less time to convert.
F. Some need technology to be converted to usable forms.

STATES

The basic states of energy are energy at rest and energy at work.

1. Kinetic energy is energy at work; the product of force and movement. (Examples: machines at work, persons at work, burning fuels.)

2. Stored or potential energy is energy at rest which can be made active. (Examples: nuclear energy, fossil fuels, a boulder on top of a hill, a battery, or water behind a dam.)

STORAGE

1. Potential energy is stored energy.

   A. Fossil fuels are stored chemical energy and are made active by combustion.
   B. Nuclear energy is stored energy in the atom.

2. Solar, tidal and geothermal energy are sources of energy flows; ways must be found to store them.

FORM: HOW CAN ENERGY BE SEEN AND FELT?

1. Energy can take many forms.

   A. Energy can be detected in the following forms: heat, light, motion.
   B. Energy can take the following forms: thermal, radiant, chemical, mechanical, sound and nuclear.

2. Energy can be measured (e.g., temperature measurement, measuring the change of position, reading meters such as gas meters, ohm meters and volt meters).

ENERGY CONVERSION: WHERE DOES ENERGY GO?

**1. Energy can be converted from one form to another.

2. Once energy is used, it cannot be used again in that form. (Note: This is a beginning level for the understanding that energy is neither created nor destroyed.)

3. In changing energy from one form to another, some energy is lost.

4. As energy is used, it produces by-products (such as heat) which may be recycled or which may be unavailable for us.

ENERGY TRANSFER

Energy is transferred by convection, radiation and conduction.

TRANSPORTATION OF ENERGY

Energy sources are transported by pipe or pipeline, radiation, ship or barge, wire or line, truck and train.

HOW IS ENERGY USED?

BASIC USES

1. Energy is needed to do work and to live.
2. Nothing acts, nothing moves without energy.
3. Energy drives the muscles of human beings.
4. Machines use energy to make things.
   A. Some machines are more efficient than others.
5. Machines use energy to change energy from one form to another (e.g., chemical to mechanical)
6. Machines use energy to change potential energy to kinetic energy.
7. Energy must be spent to get energy we can use.
8. Energy is used in our daily living to make our clothes, food, paper, and to move us from place to place in cars and busses.

PERSONAL/SOCIAL USES

1. As individuals we are personally dependent upon energy.

2. Individuals and groups have responsibility for energy conservation and use.

3. Energy can be conserved by developing energy saving habits.

4. Societal actions and values extend to exhaust available supplies of energy.

   A. Past and present use of energy resources precipitated and accelerated the energy problem.
   B. In order to impact on the energy problem, old habits must be changed.

5. Population changes directly influence energy use, availability and supply.

NATIONAL USES

1. Industry

   Industry uses much of our country's energy.

   A. About 40 percent of all energy is used by industry.
   B. Industry uses energy for heating, electricity, running machinery, electrolytic processes, processing raw materials, and maintaining a plant or office.
   C. The following industries are high users of energy: food processing, oil pumping and refining, steel and aluminum manufacturing, paper manufacturing, glass/clay/stone products, and chemical industries.

2. Transportation

   Energy is used for transportation.

   A. Transportation requires 25 percent of our country's energy.
   B. Automobiles account for more than half of the energy used for transportation.
   C. Trucks, airplanes and trains also use energy.

3. Residential

   Homes use energy for heating, cooling, lighting and appliance use.

   A. Twenty percent of the country's energy is used for residences.
   B. Homes use the highest amounts of energy for heating, water heating, refrigeration and cooking.

4. Commercial

   Energy is used for commercial places such as offices, businesses, hotels, schools, hospitals and restaurants.

MINNESOTA USE

Minnesota's use of energy is different from the national picture.

1. Minnesota has limited non-renewable energy sources.

2. Minnesota depends upon energy sources from outside the state.

3. Minnesota has special problems of transmission and transportation of energy resources.

4. Minnesota has a long heating season requiring greater residential use of energy.

CONSERVATION

1. Consumption of fossil fuels has been increasing faster than the rise in population during the past 30 years. The demand will increase.

2. We must conserve the non-renewable fuels that are left.

3. Major energy users must become big energy savers.

4. Energy conservation buys time to develop new alternative sources.

5. Some ways that major energy savings can be practiced are: Industry - building design and industrial operating changes, recycling and increased energy transmission efficiency; Transportation - mass transit and use of smaller automobiles; Residential - use of more efficient appliances, recycling and improved home insulation.

6. People must identify, examine, and clarify their own values and behave in a way that is consistent with those values.

WHAT ARE THE CONSEQUENCES OF ENERGY USE?

TRADE OFFS

1. Economic, ecological, aesthetic, political and social trade-offs are involved when decisions are made regarding the use of energy resources.

2. Energy-environment decisions require making value judgments of the trade-offs involved. A decision involves the acceptance of the possible disadvantages of the choice along with the advantages.

3. As we use up our non-renewable resources and have a hard time paying for foreign fuels, there will be more governmental action, voluntary conservation, market place restructuring or a combination of these.

ECONOMIC CONSEQUENCES

1. Supply

   A. We are consuming our energy sources faster than we are able to bring alternatives into practicality.
   B. New sources of energy must be identified and developed.
   C. U.S. oil and natural gas supplies will be depleted in about 100 years even if there is not an increase in our present rates of consumption.
   D. U.S. oil and gas production does not meet our nation's needs. Oil imports are increasing each year.
   E. Historically, there has been from three to five decades between the first speculation into new sources of energy and their commercial feasibility.

2. Cost

   A. As energy is used or conserved, there is a direct impact on economic systems.
   B. Future energy systems will demand extensive capital.
   C. High costs of new energy sources limit their use.

3. Cost/supply Interaction

   A. Shortage of a material such as oil occurs when, at a given price, the demand exceeds the supply.

B. Energy scarcity requires that growing economics make a vastly larger capital investment and/or reduce their energy demands.

ENVIRONMENTAL CONSEQUENCES

1. As energy is used or conserved, there is direct impact on our environment.

2. Energy production affects our surroundings.

3. Sources of energy that we use differ in their environmental effects.

4. A concern for the environmental consequences of energy use may require additional energy and also may demand additional money.

LIFE STYLE CONSEQUENCES

1. The relationship between energy sources, consumption and life styles must be examined.

   A. Energy use has an impact on family economics.
   B. Energy conservation has an impact on family life style.

2. Changes of energy use result in the creation of some jobs and the loss of others.

3. New or modified perceptions of living and working styles will be needed to deal with the energy problem.

POLITICAL CONSEQUENCES

1. The necessity to import oil influences U.S./foreign policies.

2. Environmental and economic effects of energy development and use affect relationships between people in regions of this country and the world.

3. If the energy problems reach a crisis stage, there will be more governmental action in the distribution and consumption of energy resources.

4. Our present energy practices will affect alternatives of societies in the future.

SOCIAL STUDIES INDEX OF ENERGY TOPICS

Compilation in *Holt* and *Windows*

	LEVEL 1		LEVEL 2		LEVEL 3		LEVEL 4		LEVEL 5		LEVEL 6	
	H*	W*	H	W	H	W	H	W	H	W	H	W
I. Basic Energy Information												
A. Definition - Properties	X	X				X		X			X	X
B. Sources - Renewable and Non-renewable	X		X		X			X		X		X
C. Forms: Chemical, mechanical, radiant, etc	X							X				
D. Uses: Residential, commercial, industrial (agriculture, food processing, mining, manufacturing), transportation, utility generation	X		X		X	X		X		X	X	X
E. Conversion technology	X		X					X		X		X
F. Ways of conserving			X					X		X	X	X
II. Society's Dependence on Energy												
A. Demands/needs related to resources (end-use) and life style	X	X	X	X	X	X	X	X	X	X	X	X
B. Effects upon Economy and Economic system	X		X		X		X	X	X	X	X	X
C. Effects on Political Relationships: local, national, international		X				X	X	X	X	X	X	X
D. Values	X	X	X	X	X	X	X	X		X	X	X
III. Possible Solutions - Problems and Advantages of Energy Alternatives												
A. Alternative Sources	X	X					X	X				
B. Conservation	X		X	X				X				X
IV. Minnesota's Energy Issues												
A. Location, Climate								X				
B. Sources Available												
C. Problems with Sources												
D. Ownership												
E. Control and effect of government policies and regulations												
F. Transportation												
G. Values												

*W = *Windows On Our World*
*H = *Holt Databank*

OVERVIEW OF ENERGY EDUCATION CONTENT WITHIN THE *WINDOWS ON YOUR WORLD* PROGRAM

Levels 1-6

WINDOWS ON OUR WORLD	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
ENERGY TOPICS						
I. Basic Energy Information						
A. Definition - Properties	4, p. 8		1, pp. 73-101	7, pp. 313-317		2, pp. 226-236 3, pp. 338-345
B. Sources - Renewable and non-renewable				1, pp. 59-65 3, pp. 148-153 4, pp. 194-201 5, pp. 231-240 6, pp. 271-276 7, pp. 306-312 7, pp. 313-317 7, pp. 331-339	2, pp. 93-95 3, pp. 133-138 7, pp. 344-351	3, pp. 338-345
C. Forms: chemical, mechanical, radiant, nuclear, electrical						
D. Uses: Residential, commercial, industrial (agriculture, food processing, mining, manufacturing), transportation, utility generation			3, pp. 164-174	3, pp. 138-147 4, pp. 194-201 5, pp. 222-229 6, pp. 271-276 7, pp. 318-323 7, pp. 325-330	3, pp. 133-138 5, pp. 241-249 5, pp. 359-362 7, pp. 390-397	3, pp. 338-345
E. Conversion technology				3, pp. 138-147 5, pp. 222-229 6, pp. 271-276 7, pp. 313-317 7, pp. 318-323	3, pp. 133-138	2, pp. 226-236
F. Ways of conserving				7, pp. 325-330	3, pp. 133-138	
II. Society's Dependence on Energy						
A. Demands/needs related to resources (end-use) and life style	2, pp. 86-87 2, pp. 88-89 3, pp. 122-123 4, pp. 152-163	5, pp. 150-163 5, p. 164	2, pp. 158-160 2, p. 174 2, pp. 202-211	3, pp. 171-178 7, pp. 325-329 8, pp. 361-366	3, pp. 125-132 5, pp. 272-286 6, pp. 328-330 6, pp. 334-340 7, pp. 398-405 7, pp. 406-412 7, pp. 428-432	3, pp. 330-337 4, pp. 458-469
B. Effects upon economy and economic system				2, pp. 117-123	3, pp. 133-138 6, pp. 334-340 7, pp. 398-405 7, pp. 405-412 7, pp. 428-432	3, pp. 330-337 3, pp. 338-345

* Houghton Mifflin, 1976

KEY: pp = pages in Teacher's Guide
Arabic Numerals = Units

	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
II. Society's Dependence on Energy (continued)						
C. Effects on political relationships: local, national, international	3, pp. 142-143		3, pp. 223-227 3, pp. 229-235	2, pp. 117-123	3, pp. 133-138 6, pp. 318-322 6, pp. 334-340 7, pp. 398-405 7, pp. 428-432 8, pp. 462-469 8, pp. 470-474 8, pp. 483-491 8, pp. 492-497	3, pp. 338-345 3, pp. 346-349 4, pp. 459-469
D. Values	2, pp. 82-93	1, p. 60 2, pp. 76-79 5, p. 164	3, pp. 218-218	2, pp. 124-131 3, pp. 171-178 5, pp. 200-207 7, pp. 305-312 7, pp. 325-329 8, pp. 366-369	3, pp. 133-138 5, pp. 226-239 7, pp. 398-405 7, pp. 406-412 7, pp. 428-432 8, pp. 492-497	3, pp. 330-337 4, pp. 459-469 4, pp. 470-481
III. Possible Solutions - Problems & Advantages of Energy Alternatives						
A. Alternative sources: types, uses, supply, time-lag values: cost, change in life style, trade offs	2, pp. 110-115 3, pp. 126-133 4, pp. 160-163	4, pp. 106-125 6, pp. 166-186		7, pp. 331-340		
B. Conservation: types, uses, supply, time-lag values: cost, change in life style, trade offs				7, pp. 331-340		4, pp. 470-481
IV. Minnesota's Energy Issues						
A. Location, climate				3, pp. 156-163 3, pp. 164-170		
B. Sources available						
C. Problems with sources						
D. Ownership						
E. Control and effect of government policies and regulations						
F. Transportation						
G. Values						

KEY: pp = pages in Teacher's Guide
Arabic Numerals = Units

WINDOWS ON OUR WORLD - ANNOTATED INDEX

Level 1

Things We Do

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
I. Basic Energy Information				
A. Definition - Properties	4	8	168-169	Making a paper glider to illustrate wind power (opportunity to define energy)
II. Society's Dependence on Energy				
A. Demands/needs related to resources (end-use) and life style	2	3	86-87	Looks at physiological needs of living things (opportunity to relate meeting needs using resources).
	2	4	88-89	Discuss how humans and living things keep safe and warm (could be extended to include other ways we keep warm and the energy required to supply heat).
	3	1	122-123	Develops idea of interdependence of people.
	4	Entire Unit	152-163	Deals with life style related to space requirements and use of space (readiness for this energy topic).
C. Effects on political relationships: local, national, international	3	11	142-143	Picture of school steps with lunch litter, discussion of rules and needs for participation (opportunity to relate this concept to use and conservation of energy).
D. Values	2	1-6	83-93	Respect for the natural environment.

*Pages in Teacher's Guide

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
III. Possible Solutions - Problems and Advantages of Energy Alternatives				
A. Alternative sources (types, uses, supply, time-lag)	2	15-17	110-115	Good sequence on decision-making process (readiness experience for looking at alternatives related to energy).
(values: cost, change in life style, trade-offs)	3	3-6	126-133	Focus on conflict resolution with conflict over scarce resources and consideration of social cost (the situation in these lessons is not related to energy, but the concepts and process are applicable).
	4	4-5	160-163	Deals with consideration of alternative uses of space (readiness experience for energy education topic).

WINDOWS ON OUR WORLD - ANNOTATED INDEX

Level 2

The World Around Us

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
II. Society's Dependence on Energy				
A. Demands/needs related to resources (end-use) and life style	5	12-18	150-163	Deals with human dependence on the natural environment (good readiness concept building for energy topic).
	5	19	164	Conclusion of Unit 5 (could be extended to apply to energy use), see listing under D. Values below.
D. Values	1	10	60	Asks students to demonstrate their respect for natural environment by suggesting ways to improve it. (basic readiness for considering some problems related to energy use).
	2	2&3	76-79	Explores feelings related to plants, animals, seasons, weather.
	5	19	164	Conclusion of Unit 5 (listed above in A., also) students are asked to demonstrate respect for the natural environment by explaning how important natural phenomena are to people. (This sensitivity to the relationship between natural environment and people is important to the later consideration of energy uses).

*Pages in Teacher's Guide

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
III. Possible Solutions - Problems and Advantages of Energy Alternatives				
A. Alternative sources (types, uses, supply, time-lag)	4	Entire Unit	106-125	This entire unit develops the skills necessary to consider alternatives and to make value judgments.
(values: cost, change in life style, trade-offs)	6	Entire Unit	166-186	Focuses on actions and consequences of actions. Students are asked to evaluate situations in order to think through results of alternative courses of action and alternative solutions to problems, to consider how their actions can affect them, affect other people, and affect the natural environment. (These situations are not directly related to energy, but the thinking process and concepts are basic to this topic and are valuable "readiness experiences" for considering the energy problems and possible solutions at a later time.)

WINDOWS ON OUR WORLD - ANNOTATED INDEX

Level 3

Who Are We

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
I. Basic Energy Information				
A. Definition - Properties B. Sources - Renewable and non-renewable	1	6,8 9-14	73-101	Entire unit is a study of planet Earth. Lesson 6 (Tg pp. 73-76) introduces idea of spaceship Earth. Lesson 8 (80-81) develops idea of systems made up of parts that operate as a harmonious whole. Lesson 9-12 look at the main components of this system - air, water, food, solar energy. Lesson 13 (94-97) focuses on the problem of limited resources on spaceship Earth. Lesson 14 (98-101) indicates that careful planning is necessary for the smooth operation of spaceship Earth. *Lesson 12 (solar energy) and 13 (scarce resources) provide opportunities for extended lessons directly related to energy. (This material also relates to II. Society's Dependence on Energy.)
D. Uses: residential, commercial, industrial (agriculture, food processing, mining, manufacturing), transportation, utility generation	3	6	64-174	Discusses things people in a community share, using as examples electricity and transportation. (Could be extended to look at energy uses in the community).

*Pages in Teacher's Guide

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
II. Society's Dependence on Energy				
A. Demands/needs related to resources (end-use) and life style	2	12	158-160	Lesson theme is how we use tools. Makes the point that tools are a part of human culture. (Can be extended to look at kinds of tools in our own lives and the energy sources used and how the use of tools affect our life style.)
	2	16	174	This is a summary lesson of Unit 2. Asks the question: what does culture do? Focuses on ways culture helps humans meet their needs, e.g.: tools, language, and institutions. (Extension of this lesson could lead to a study of tools and ways they have changed over time and are different from culture to culture, with a look at the accompanying impact on life-styles in the varying settings.)
	3	6	202-211	Looks at things people in a community share e.g.; electricity, transportation (Opportunity to study shared energy sources; impact on our life style by the energy-using services we all use and share.)
C. Effects on political relationships: local, national, international	3	10	223-227	Conflict and Cooperation in Your Country is the title of this lesson. The conflict centers on lobster beds on the East Coast. Lesson moves to a consideration of cooperation among states and pictures a dam used to produce hydroelectric power. (Extension of this lesson is possible.)

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
II. Society's Dependence on Energy (continued)				
	3	12	229-235	(See lessons 13 & 14, also) Develops idea of trade network among nations, classifies goods traded between U.S. and other countries (could be extended to look at the importation of oil by our country).
D. Values	3	7	213-218	Case of conflict within a community over land use. Study of factors in decision-making including looking at alternatives. (Good basic experience for later study of energy alternatives.)

WINDOWS ON OUR WORLD - ANNOTATED INDEX

Level 4

Planet Earth

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
I. Basic Energy Information				
A. Definition - Properties	7	2	313-317	Energy: what makes things work, change, move.
B. Sources - Renewable and non-renewable	1	3	59-65	Sun: part of natural system.
	3	2	148-153	Earth and sun interact to heat air-ocean.
	4	2	194-201	Ocean currents related to energy.
	5	2	231-240	Formation of energy resources from organic material. Fossil fuels are in limited supply.
	6	3	271-276	Sun as source of all energy. Energy from sun for plant life.
	7	1	306-312	Cultural recognition of sun's energy.
	7	2	313-317	Energy resources that are common. Facts related to sun's energy.
	7	5	331-339	Solar, geothermal data.

*Pages in Teacher's Guide

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
D. Uses: residential, commercial, industrial (agriculture, food processing, mining, manufacturing), transportation, utility generation	3	1	138-147	Moving air: - power and uses.
	4	2	194-201	Moving water: - power and uses.
	5	1	222-229	Energy from volcanoes and earthquakes change land surface and land use.
	6	3	271-276	Food chain, food pyramids.
	7	3	318-323	Uses.
	7	4	325-330	Growing need related to population growth.
E. Conversion technology	3	1	138-147	Wind power and uses
	5	1	222-229	Differences among formation of some sources of energy.
	6	3	271-276	Converting food to animal energy.
	7	2	313-317	Plants to fuel; plants to food to muscle power.
	7	3	318-323	Fossil fuels to electricity to heat, light, sound.
F. Ways of conserving	7	4	325-330	Conserving energy at home, school, community.
II. <u>Society's Dependence on Energy</u>				
A. Demands/needs related to resources (end-use) and life style	3	5	171-178	Case studies related to polluting effects of energy use.
	7	4	325-329	Growing need for energy related to life style.

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
II. Society's Dependence on Energy (continued)				
	8	3	361-366	Effects of space technology on our culture.
B. Effects upon economy and economic system	2	7	117-123	Production/consumption of energy-based goods and services.
C. Effects on political relationships: local, national, internation	2	7	117-123	Interdependence among countries.
D. Values	2	8	124-131	Choice-making related to production.
	3	5	171-178	Decision-making related to polluting effects of energy use.
	5	3	200-207	Evaluating changes in land use related to energy needs.
	7	1	305-312	Cultural beliefs about importance of sun.
	7	4	325-329	Choice-making related to energy use and needs.
	8	4	366-369	Trade-offs related to use of energy for space technology and to making earth a better place to live.
III. Possible Solutions - Problems and Advantages of Energy Alternatives				
A. Alternative sources (types, uses, supply, time-lag)	7	5	331-340	Alternatives described: nuclear, shale oil, solar, geothermal, wind and water power.

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
III. Possible Solutions - Problems and Advantages of Energy Alternatives (continued)				
(values: cost, change in life style, trade-offs)	7	5	331-340	Criteria for meeting future needs.
B. Conservation	7	5	331-340	Evaluates future sources; costs, and changes anticipated.
(types, uses, supply, time-lag)				
(values: cost, change in life style, trade-offs)				
IV. Minnesota's Energy Issues				
A. Location, climate	3	3	156-163	Causes/effects of climate.
	3	4	164-170	Opportunity to discuss energy needs for living in different climates, locations.

WINDOWS ON OUR WORLD - ANNOTATED INDEX

Level 5

United States

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
I. Basic Energy Information				
B. Sources - Renewable and non-renewable	2	4	93-95	Overview of land use and resources.
	3	5	133-138	Distribution of energy sources held and used by U.S. compared to world's energy resources.
	7	1	344-351	Technology that developed from use of new energy sources in 1800's.
D. Uses: residential, commercial, industrial (agriculture, food processing, manufacturing, mining), transportation, utility generation	3	5	133-138	Fuel-powered transportation; gasoline shortage of 1973; interrelatedness of environment and search for oil.
	5	3	241-249	Wind and muscle powered transportation used by explorers.
	5	4	250-255	Europeans bring new sources of power to Native Americans.
	6	8	359-362	Use of water power in North and South before Civil War.
	7	1	390-397	New energy sources led to inventions.
E. Conversion technology	3	5	133-138	Electric power from using other resources.
F. Ways of conserving	3	5	133-138	Short-term results of oil shortage.

*Pages in Teacher's Guide

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
II. Society's Dependence on Energy				
A. Demands/needs related to resources (end-use) and life styles	3	4	125-132	Compare energy used to transport 1 person in canoe with computer controlled train transportation.
	5	7	272-286	Compare use and kinds of energy in colonies.
	6	2	328-330	Use and kinds of energy used in westward movement.
	6	4	334-340	Transportation and agricultural inventions used different forms of energy.
	7	2	398-405	Use of new energy sources led to social change in the 1800's.
	7	3	406-412	Large-scale use of energy in farming and manufacturing early 1900's.
	7	6	428-432	Increased use of energy by urban society.
B. Effects upon economy and economic system	3	5	133-138	Availability and use of world energy resources; U.S. using large share; profits in drilling and searching for oil.
	6	4	334-340	Changes caused by using steam power and wind power for new inventions helped westward movement and settlement and began productive use of Great Plains.
	7	2	398-405	Big business control of energy-based manufacturing in early 1900's; concerns of early environmentalists.

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
II. Society's Dependence on Energy (continued)				
	7	3	406-412	Large scale use of energy resources for mass production.
	7	6	428-432	Heavy use of energy resources in urban society-jobs, transportation.
C. Effects on political relationships: local, national, international	3	5	133-138	Availability of world supply of fossil fuels; Arab countries have most reserves; effects of war with Israel on U.S. imports; future problems, concerns.
	6	1	318-322	Use of energy during Lewis and Clark expedition.
	6	4	334-340	Political effects of settling the west through new energy-powered inventions.
	7	2	398-405	Conflict about early conservation efforts.
	7	6	428-432	Immigration laws affect urban life.
	8	1	462-469	U.S. involvement in Canada's resource based industries.
	8	2	470-474	U.S. involvement in Mexico's development of technology.
	8	4	483-491	Use of energy and advanced technology during WW I and WW II.
	8	5	492-497	Present day concern for global issues.
D. Values	3	5	133-138	Focus on fair share use of world supply of fossil fuels; future energy problems.

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
II. Society's Dependence on Energy (continued)				
	5	2	226-239	Use and relationships between Native Americans and natural environment; compare energy use and different technologies of Osage and Aztec peoples.
	7	2	398-405	Evaluate control of resource-based industries in big business.
	7	3	406-412	Problems of assembly-line production.
	7	6	428-432	Relationships between automobile and growth of suburbs and city problems.
	8	5	492-497	Concern for world community.

WINDOWS ON OUR WORLD - ANNOTATED INDEX

Level 6

The Way People Live

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
I. Basic Energy Information				
A. Definition - Properties	2	10	226-236	Calorie defined.
	3	7	338-345	Energy related to work as a force or ability.
B. Sources - Renewable and non-renewable	3	7	338-345	Fossil-fuels and muscle power used in pre-industrialized past.
D. Uses: residential, commercial, industrial (agriculture, food processing, mining, manufacturing), transportation, utility generation	3	7	338-345	Overview of first and second industrial revolution relating to energy use.
E. Conversion technology	2	10	226-236	Energy from food.
II. Society's Dependence on Energy				
A. Demands/needs related to resources (end-use) and life style	3	6	330-337	Compare use of fuel and power with level of technology and life style.
	4	3	459-469	Urban problems related to industrializing and highly industrialized nations; energy use related to land use.
B. Effects upon economy and economic system	3	6	330-337	Compare pre-industrial, industrializing, and high industrialized economies

 *Pages in Teacher's Guide

TOPIC	UNIT	LESSON	pp. TG*	ANNOTATIONS
II. Society's Dependence on Energy (continued)				
	3	7	338-345	Energy consumption in industrialized economies.
C. Effects on political relationships: local, national, international	3	7	338-345	Use of energy by world regions.
	3	8	346-349	Changing travel time around world related to use of different forms of energy and inventions.
	4	3	459-469	How governments try to cope with urban problems.
D. Values	3	6	330-337	Attitudes toward differing life styles using differing amounts of fuel and power.
	4	3	459-469	Rank-ordering alternative solutions to urban problems.
	4	4	470-481	How values are reflected in plans for future.
III. Possible Solutions - Problems and Advantages of Energy Alternatives				
E. Conservation (types, uses, supply, time-lag) (values: cost, change in life style, trade-offs)	4	4	470-481	Opportunities to include conservation of energy resources in planning future communities.

RELATED ACTIVITIES: IDEAS FOR ADDITIONAL TEACHING AND LEARNING ACTIVITIES

1. DEFINITIONS

Have students find the word "energy" in glossary of text, then create a symbol or picture for the definition. Display their work.

Grade 4 glossary entry: the strength or power to move, to grow, to change things, or to do work.

Grade 5 glossary entry: the power to move or change things; for example, to give off heat or to operate machinery.

Grade 6 glossary entry: the ability to do work.

2. LEISURE TIME

Ask students to list leisure time activities that their own family enjoys. Have students code those that depend on the use of electricity or gasoline. Discuss.

3. ENERGY BINGO

Ask class what comes to mind when they hear word "energy". List at least twenty words on chalkboard. (This will give you an idea of class's energy vocabulary and concepts. Have each student fold paper into 16 squares; tell them to fill one square with word "sun"; this will be "free" square. Have students fill in other squares as they wish with words from the chalkboard. You mix up and call out words; as they find one on their paper that matches, they X it out. When they complete a row (across, down, diagonally), they call "Bingo." (This works best after terms have been introduced. Add another dimension by having the first winner guess who will be the second winner, etc.)

4. TV COMMERCIAL

Have small groups plan and present a TV commercial that might convince people to cut down on use of energy. Each group could concentrate on electricity or gasoline or natural gas.

5.	ENERGY COLLAGE	Have groups use magazine pictures to show relationships between primary energy sources, both renewable and non-renewable and uses. For example: sun-plants-food; oil well--gas pump--car.
6.	BIRTHDAY CANDLE POWER	Use unlit birthday candle to discuss concept of energy at rest (potential or stored energy). Light it to discuss concept of observing energy at work (kinetic or active energy). What energy is detected (heat, light) as candle burns? Use two pictures (Fideler, Silver Burdett, WOW activity cards, others) that show mainly potential energy and kinetic energy. Have small groups find and categorize other pictures, then choose the one they feel represents the best example of each and show choices to the class.
7.	ANIMAL CRACKERS	Give each student an animal cookie. Have student tell were it belongs on the food pyramid. Use with Level 4 WOW, Unit 7, Lesson 2.
8.	SCHOOL ENERGY SURVEY	Have small groups prepare interview questions and survey school for ways energy is used other than for heating and lighting. (Questions for engineer or custodian can relate to floor machines, grass cutting, snow removal. Questions for office staff can relate to typewriters, duplicating and Xerox machines. Questions for AV person can relate to a variety of equipment. Questions for lunchroom staff can relate to transportation and preparation of food. Questions about parking lot and playground can relate to lights at night, trash disposal trucks, buses transporting students, private cars.) Chart the information and discuss. Results may be shared, for groups may suggest ideas that are practical ways to save energy at school, other than turning off lights and turning down thermostats. Post the ideas in strategic places.
9.	HOME ENERGY SURVEY	Have students list every appliance the family uses besides those used to heat and light the home. Check kitchen: stove, electric can opener, electric knife, refrigerator, iron, electric fry pan, corn popper, electric roaster, microwave oven, toaster, mixer, radio, TV. Check bathrooms and bedrooms: hair dryer, electric blankets, curling iron, electric tooth brushes, fans, sun lamps. Check laundry and utility closet: washer, dryer, hotwater heater, vacuum, hand-vacuum. Check other rooms: stereos, TV's and radios, fans, or air-conditioning. Discuss the idea that all new appliances must have an EER (energy-efficiency rating). Have each student

		check the five appliances that are most important to her/him. Ask students to think about what they have learned about themselves.
10.	ADVANTAGES-DISADVANTAGES	An extension to #9. above is to have students list advantages and disadvantages related to an appliance they use often, such as time saved, work made easier, steps saved, etc.
11.	COOPERATION-COMPETITION GAME	Prepare four index cards by drawing 12 lines across each, like 12 rungs on a ladder. Divide class into four color teams. Give each team one index card and a different color marker (may be a crayon). Explain rules: each team is to try to get rungs of the ladder colored; no adjoining rungs may have the same color; a team may not use its own color; each team must offer to color a rung in exchange for another team coloring their rung. When ladders are all colored, explore: why did we act as we did; how did one person's actions make someone else act; what feelings did we have; when is cooperation better than competition. Relate to energy shortage.
12.	INTERVIEW	Have students interview grandparents or someone who lived in the 20's and 30's to find out: how their home was heated and cooled; how food was prepared and kept cool; how they went to school; how they shopped for food and other needs; how and where their families went for leisure-time activities; how clothes were washed and dried, etc.
13.	REDDY KILOWATT	Tell students that an advertising slogan NSP used several years ago was "Electricity is penny cheap-from NSP." Have them make up slogans that NSP could use today.
14.	MURAL	Using Holt as a reference, make an energy use study by making a mural of the ways the various countries consume energy. (U.S.A., Japan, Kenya, Borneo, Germany, etc.) This could be based on actual facts that have been researched by the children or could come from their good deductions after seeing pictures in their books.
15.	FIELD TRIP	Visit a place where energy is converted or used in large amounts. Have the children prepare a set of questions they want answered about energy.

16. **GROUP & LABEL**

Collect Sunday newspaper advertising inserts and catalogs advertising home appliances and tools for home use. Cut apart to separate each item. Have pupils group the items in as many ways as they can and label the groups. The groups that are formed will probably relate to the use, the power used, or the value (most important to least important need) of the tools. Discussion following this activity should make the class aware of the many ways we depend on energy and sensitive to the differing priorities people may have for the importance of specific tools.

17. **PRODUCERS CAN HELP, TOO**

Save the enclosures from NSP, Minnegasco, etc. monthly bills. Clip ads that stress gasoline-efficient engines in cars, energy-efficient refrigerators, etc. Have class discuss ways that business firms do and can help us save energy.

18. **NOW & THEN**

Compare the items in Sears catalog of 1906, 1928 and the 1970's. (See Learning Materials List for ordering these catalogs.) What are some statements that can be made about the changes in products during those years and the use of energy required. How have these changes affected our life style?

19. **MEETING NEEDS-USING ENERGY**

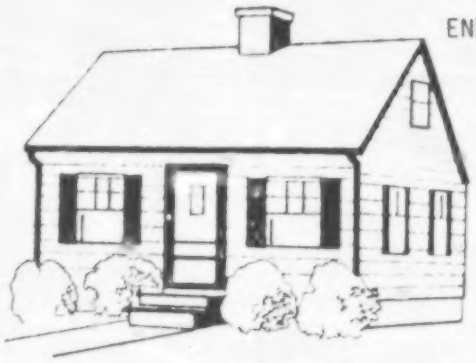
List the basic needs people have for physical survival - food, shelter, and clothing. Divide the class into six groups - two groups for each of the categories, food, shelter, clothing. Assign one basic need to each group and ask the group to indicate the kind of energy used to meet that basic need. (See suggested worksheet form.)

If filmstrips and study prints are available as resources, some groups might be asked to indicate how these basic needs were met in pre-industrial times or in other cultures, e.g., caves, log houses, tepees, huts, home-grown food, spinning wheel, etc. Compare the energy used from one time or place to another.

Some classes might want to look at ways these basic needs might be met in the future with the emphasis on different energy sources and/or less energy use, e.g., solar heat, underground homes, different transportation systems, synthetic food, etc.

Worksheet for Activity #19

GROUP _____



ENERGY NEEDED - to build the shelter

- to live in the shelter

GROUP _____

ENERGY NEEDED - to produce the food

- to prepare and serve the food

GROUP _____

ENERGY NEEDED - to manufacture clothing

- to maintain clothing

IDEAS FOR USING SELECTED ACTIVITY CARDS (*WINDOWS ON OUR WORLD*)

Pictures on the front of the activity cards, especially the Environmental Studies (coded ORANGE) and the Geography (coded RED), offer opportunities to emphasize energy awareness and energy education.

Examples, RED cards:

Card 1: How many sources of energy are pictured?
3: What kinds of energy might be used to process foods, pack, develop labels, ship, etc.?
5: What energy needs are used for transporting goods and services?
9: Relate to energy needs for light and heat.
11: Why are lights needed for a parking lot at a shopping center?

Examples, ORANGE cards:

Card 27: What forms of energy might have shaped the land surface? trees?
28: Relate to the use/misuse of end-products of energy-based industries. Which items might be recycled?
29: Make up a law about the use of gasoline and how many persons should be transported. Would the law take away people's freedom?
31: What might be the most energy efficient way to clean up litter and trash?
32: Which electric appliance is needed most, thinking only of basic needs?